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The Province of Alberta

IN THE MATTER OF THE PUBLIC INQUIRIES ACT

AND IN THE MATTER OF O/C 290/73, AN INQUIRY INTO THE NEW TOWN OF GRANDE CACHE

N. R. CRUMP, Esq.,	Chief Commissioner
T. H. PATCHING, Esq.,	Commissioner
DAVID GRAHAM, Esq.,	Commissioner

W. A. Stevenson, Esq.,	Commission Counsel
D. O. Sabey, Esq., Q.C., and J. G. Martland, Esq.,	For McIntyre Porcupine Mines Ltd.
Lorne Ingle, Esq.,	For United Steelworkers of America.

DATE: October 3, 1973

HELD AT: Edmonton, Alberta.

VOLUME XVII

(Pages 1598 - 1682)

Supreme Court Reporters
EDMONTON, ALBERTA

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I N D E X

VOLUME XVII

October 3, 1973

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PROCEEDINGS before the Board of Commissioners, at the Law Courts, City of Edmonton, Province of Alberta, commencing at 9:30 a.m., Wednesday, October 3rd, A.D. 1973.

MR. CRUMP: Mr. Stevenson, carry on.

MR. STEVENSON: Yes, Mr. Boyd.

J. T. BOYD RECALLED, FURTHER EXAMINED BY MR. STEVENSON:

Q You understand, Mr. Boyd, that you're still under oath?

A Yes sir.

Q Mr. Boyd, at the conclusion of your evidence yesterday, you were indicating, giving us some indication of the methodology of hydraulic type of mining, and you are currently, as has already appeared in evidence before us, undertaking a feasibility study of hydraulic mining for McIntyre Porcupine in the No. 3 mine area?

A Yes sir.

Q And I take it that study is not yet completed?

A That's correct.

Q And have you knowledge of the geology in the No. 1 mine area?

A Yes sir.

Q And would you consider that the possibility of hydraulic mining in that area should also be investigated?

A At the present time I have that assignment.

Q And would you consider, from your experience, that the prospects of hydraulic mining are better than the prospects of mechanized long wall mining, or some other mechanized mining, continuous mining operations, in these steeply pitched inseamed areas?

A Well, before going on record, I would like to have my feasibility study completed.

Q I'm not trying to commit you to that. I'm just saying that the overall, even if we don't restrict it to this area, in general, in extremely pitching seamed areas of a thickness of 20 to 24 feet, what are the prospects, or reasonable sort of prospects for mechanized development?

A The seams that are steeply pitched in, say, over 20 to 25 degrees can be mined hydraulically, if the seams are, say, 24 feet thick then economically, in my opinion.

Q Yes, and I realize that you've got to do more work --

A Right.

Q -- to give that very firm opinion.

A Right.

Q I was just asking if you could compare the prospects for hydraulic mining to the prospects for development of long wall or some other mechanized hydraulic mining?

A Right. The critical point on long wall mining is having a twelve per cent gradient and as long as you have a twelve per cent gradient, you can apply your hydraulic haulage and hydraulic mining.

Q I follow you. I was just wondering, Mr. Boyd, whether the prospects in the steeply pitched areas are better for mechanical mining or hydraulic, in your opinion?

A Well, after you get above 20 to 25 degrees, your conventional

1-HG-3
J. T. Boyd - Stevenson Ex.

A (Continued) and continuous mining equipment is more or less eliminated due to the steepness of the gradient, and from there you go to either long wall mining or hydraulic mining or some other type of mining, and I would say that hydraulic mining has as good a chance of mining coal on those gradients as any type mining there is.

Q Now, Mr. Boyd, in connection with the matter in respect of which you have done feasibility studies, namely, the strip coal reserves, and you gave all your evidence in that connection yesterday, what do you see the operation as needing in order to ensure the proper development of the strip reserves and the realization of the potential of the strip reserves? What kind of expertise is needed?

A Well, right at the moment, they have 9.6 million ton in the No. 9 mine area, plus 1.5 in the No. 8 area, that is, I would say proven, and then the additional ten million ton in the No. 9 area is right on the fringe of becoming economic and, in my opinion, by the time they are ready for that coal, they will, that will be economical. However, the mine has got to keep working and develop proven reserves in different areas that there are on a property and really do some detailed engineering to keep five to ten years of strip coal ahead of them at all times.

Q You indicated yesterday that there had to be some long-range planning in order to preserve or protect whatever deep reserves

Q (Continued) there were in the No. 9 area as well?

A Right.

Q Is that correct?

A And as they strip they will open up more or less so-called high wall mining, where they end up stripping they will be able to enter the seams and go to deep mining.

Q Will this require again long-range planning and engineering?

A Yes sir.

Q And do any special steps need to be taken to ensure that this expertise is available?

A No, I would say the present management is working on building up their engineering department and also their operating department to take care of all this long-range planning.

Q Do you see it necessary to build up in the engineering department?

A Well, they have, as I size it up in the limited time I have been around, they have a lot of engineers, however, they probably do need a long-range top level engineer to be more or less the director of engineering.

MR. STEVENSON: Those are all the questions I have, Mr. Boyd.

MR. CRUMP: Mr. Sabey?

MR. SABEY: Thank you, Mr. Chairman.

MR. SABEY EXAMINES THE WITNESS:

Q One or two items I would like to cover. You indicated yesterday that the report of the U.S. Bureau of Mines for the first four months of '73 indicated coal exported to Japan had an average value of $20.26 per net ton?

A Right.

Q Now, sir, that Japanese trade includes low, medium and high volatile coal, does it not?

A Well, as the Japanese report the high percentage of their importation what they call hard coking coal, which falls in the medium and low volatile coal.

Q McIntyre is shipping a premium quality low volatile coal, are they not?

A Yes, sir.

Q And similar coal mined in the U.S. ranges between $23.00 and $25.00 f.o.b. Hampton Roads, doesn't it?

A Well, I would not know that to be exact.

Q Well, sir, in any event, the point that Mr. Stevenson was making with you was that, that McIntyre was getting a top price and perhaps they couldn't expect the top price or couldn't expect an increase, but I am not entirely clear on your position, sir, because you later said that it might justify going higher. Now could you help me in that regard? Do you feel it might go higher?

A Well, I will tell you the price of coal is going to depend upon the demand for sure, and you take the McIntyre coal

A (Continued) were volatile and ash and it's, all it's quality in all fairness it does not stack up to the Pocahontas Coal in Virginia and West Virginia, and considering everything and considering long range contracts which the steel companies in the States are paying for coal, I would say that the 21.95 that McIntyre is getting for their coal is a top price at this time.

Q For today?

A Yes.

Q But that is the point, sir, that is top for today?

A Right.

Q And any discussion about future markets is highly conjectural?

A That's right.

Q In point of fact coal has gone up what, two dollars in the last year? Or a dollar?

A Well, it went up say in the U.S. about one dollar.

Q So far?

A Right. There is another, you know, increase coming up but it's strictly escalation on --.

Q Sir, do I understand correctly that in West Virginia the U.S. Steel has conducted strip operations at, with the stripping ratios of between 15 to 20 to 1?

A Right.

Q And --

A That is possible by contour stripping around the mountain sides.

Q And the point you made was that is a matter of planning?

A Well, that and also the character of the coal and the way they handle their spoil.

Q Yes. Well, sir, one other point I wanted to be clear on, you have spoken about breaking points of between 20 and 25 degrees?

A Right.

Q You have used as high as 25 degrees in prior reports, sir?

A Twenty-five degrees is the maximum that we go to, yes.

Q Yes. Now, sir, in discussing the reserves in the No. 9 strip, I wasn't clear what those mineable reserves are that are available with this large equipment you were discussing yesterday?

A In the report I have the 9.6 million tons of readily available reserve.

Q Yes, sir.

A Then I took an alternate A which came up with or would be --.

Q I now have a copy of that and I can follow you I hope.

A Okay, on page 4 B, item 7. It could be 19,964,000 raw tons at 11.32 ratio--

MR. CRUMP: 4B, Mr. Sabey.

Q MR. SABEY: Thank you. And that, sir, is with this very large equipment --

A No, I made the statement there that in my feasibility estimate on strip coal --

Q Yes, sir.

A -- being economical we used a figure of 53 cents per cubic

A (Continued) yard and for this 11.32 tonnage to become economicalways would have to be developed to move that overburdened for say 46 cents a cubic yard.

Q And did that then involve this very large equipment you have spoken about?

A Not necessarily.

Q Well, sir, does it follow that the larger equipment may effect a greater economy and you may then with the larger equipment go to a higher ratio?

A Yes, sir.

Q But you haven't been able to calculate what the reserves might be if you have these two conditions?

A No.

Q But presumably --

A I went one step further and if you go to 4C I say the No. 9 mine alternate B, which is detailed on tabulation 4 shows there could be 76,309,000 recoverable raw tons of metallurgical quality coal at a 15.47 to 1 stripping ratio, and that would take equipment that would move the overburdened in the order of 33 at 35 cents per cubic yard.

Q And that again would depend --

A On the larger equipment.

Q Thank you. Mr. Boyd, you have seen the reports which the company has in its possession of evaluating the mining, the surface mining potentials?

A I have seen I would say some of them. I am not sure whether I have seen all of them.

Q Well, from those you have seen your evaluation of the surface mining doesn't vary greatly from the company's reports, does it?

A That's right.

Q And you are aware of the company's plan for this mining?

A Yes.

Q And do you suggest any changes from those plans, sir?

A I have not seen the detailed plan but the overall plan they have is in order.

Q Sir, I gather in 1969 your company prepared a report for Kaiser Resources Limited, and I would like to read to you from page 16 of the Prospectus which summarizes your report as follows:

> The company's underground costs estimate is based on improved mining methods now being initiated. If this cost cannot be met the required tonnage will be replaced by added open cut coal which can be mined in this cost range. Accordingly we have accepted the company's estimates and consider its five year projection to be realistic.

Now, sir, isn't this almost exactly the current position of McIntyre Porcupine?

A I would say so, yes.

Q I also note in the summary, sir, that you have indicated the company was -- that Kaiser was then considering the possibility of utilizing the longwall method. Do you know if that was ever

Q (Continued) implemented?

A No, it has not.

Q Thank you. Now, sir, if we were to project the Japanese requirements as reflected in the original contract which is no longer outstanding, I think that is clear?

A Right.

Q But if we were to take the same projections do you doubt that McIntyre would be able to fulfill the requirements of the Japanese for another 10 or 11 years?

A To reach your 2 million ton per year my opinion is going to take at least another year and with detailed planning you should meet that 2 million ton a year for the next 10 or 11 years.

Q Sir, do you doubt that McIntyre can continue to mine coal in the future? Now that is a very general question, I appreciate, sir, and if you want to qualify that in any way please do so.

A I will qualify it in this way that there is a lot of research that McIntyre has got to do, and they got their 20 mine which has been reported on as having upwards to 100 million tons of strip coal. However, it's off grade as being metallurgical coal by itself. And I'd say that McIntyre has got to do some research and see if that coal cannot be blended with their real good coking coal and make it a salable product, and if that could be done the future of McIntyre would be that much brighter.

Q Yes, sir, well, sir, you have had the opportunity to conduct some reviews into this and I am going to ask you, is your own

Q (Continued) view that of pessimism or optimism in that respect?

A Well, put it this way, if I had the property I would start some research on it as soon as money becomes available.

1-LP-1
J. T. Boyd - Sabey Ex.
- Patching Ex.

Q Excuse me one moment, sir. Sir, you have talked about the present potentials in your evidence yesterday and today, would it be accurate to say that today in the industry they are mining coal that couldn't have been mined 20 years or even 10 years ago, whether that is due to improved techniques or equipment or even just economic conditions?

A I would say yes, sir.

Q And couldn't the same be said today some 10 years from now?

A That would be a good projection, yes.

Q Indeed, you have indicated that you are hopeful that things will improve or, there has been some improvement in the last five or six years?

A Yes, sir.

Q Thank you very much, Mr. Boyd.

MR. CRUMP: Mr. Patching, have you questions of the witness?

MR. PATCHING: Yes, I have a few.

MR. PATCHING EXAMINES THE WITNESS:

Q Can you tell us, Mr. Boyd, referring to the cleaning plant, how does the actual plant recovery now compare with the theoretical recovery of, say, the sink and float test?

A The sink and float test show that the theoretical recovery should be 73 per cent and right now are running roughly 7 per cent of the raw coal feed to the plant after it goes through the breakers.

Q Is this an acceptable difference?

A Yes, I would say so.

Q And would you consider that the other performance, the operating

Q (continued) costs of the cleaning plant are reasonable at this point?

A At this point I would say the operating costs of the plant are on the high side. However, with increased tonnage that will straighten itself out, I am sure.

Q Now, I understand the performance of the cleaning plant was very much below requirements and projections for a long time and fairly extensive modifications have been required. Are there any lessons that can be learned from this regarding cleaning plant design in this country?

A Yes, sir. I think every cleaning plant built including Kaiser, and I don't have any information on Fording River, Luscar got by by building a 1.8 million ton plant and only running a million and McIntyre ran into the same problem and the problem was that everybody missed the percentage of plus and minus 28-mesh coal. Most of the plants were designed, say for 20, 25 per cent and when they got to mining it turned out they had 30, 35 per cent which required more fine coal cleaning.

Q There were other operating deficiencies as well?

A Oh, yes, right.

Q But you think these have been remedied?

A Right.

Q And overcome at this point?

A Right.

Q Now, concerning the strip operations, the strip ratios that you quoted are the average strip ratios?

A Right.

Q That you would expect. Now, there is also another ratio that is important, the incremental ratio, the ratio to the boundary of the pit?

A That is right.

Q And when you are dealing with an average strip ratio of 8 would it be proper to assume that you are also considering an incremental ratio of something of the order of 10 or 11?

A In a few cases, yes. A good example of that is No. 8 mine with the equipment they have, they are cutting off at, say, a 2½, 3½ ratio whereas if they had larger equipment they could go back into deeper overburden and recover more coal.

Q So that for satisfactory performance from an open pit it would require both an acceptable average strip ratio and an acceptable strip ratio on the boundaries?

A Right, and you know, with detailed mine planning you try to plan your cuts and benches that you are going to end up the year with an average ratio.

Q The ratios that you have counted, reported on, do recognize this limiting ratio of the boundaries?

A Yes.

Q Now, in this tabulation on 4B, referring to truck and shovel operation, you have shown a total of only about 11½ million tons having a ratio under 8?

A Yes, sir.

Q And when you calculated your costs for a truck shovel operation you were looking at a production of about 1.7 million tons a year clean coal, it would be about 2.4 million tons of raw coal?

A Well, that is a figure, we had to take some figure and that figure happened to be the capacity of the cleaning plant on a 5-day basis and it had no connection with our actual projections.

Q Well, if your truck shovel operation were operating a smaller output, could you still operate at the same strip ratio or would you have to look at higher costs?

A No, you would operate at the same ratio. However, if you wanted a higher tonnage you may have to add a third truck and shovel unit.

Q I was wondering whether this 11½ tons would be enough to justify the acquisition of equipment for such an operation, it only amounts to about 5 years production?

A Yes. Well, you have to take into consideration that during those 5 years I am of the opinion that the additional 10 million will become economic.

Q By bringing in a dragline?

A Or just improving on their mine techniques with the equipment they have. I think it is within that realm of making the reduced cost.

Q This is assuming the selling price of coal goes up in proportion to the cost of labour and other supplies that are going up?

A Yes, right.

Q Now, referring No. 14 mine where there are substantial tonnages shown, do you think that strip mining would be permitted in this area from an environmental point of view?

A I see no reason why it shouldn't be.

Q Grande Mountains are a fairly scenic point of view?

A Yes, that is right, but you can end up with a strip mine, say, maybe 10 years from now that would be more scenic than it is right now.

Q And one other question, do you think a case could be made for a higher price for coal from Vancouver sailing for Japan than from Virginia because of the lower ocean freight rates from these ports?

A Well, this is a possibility but, when you get into an argument like that you have to go into great detail on your quality because certain coals have certain qualities and everything has to be taken into consideration.

Q Those are all the questions I have.

MR. CRUMP: Mr. Graham?

MR. GRAHAM: No, I have no questions.

MR. CRUMP EXAMINES THE WITNESS:

Q Mr. Boyd, relative to Commissioner Patching's last question, of course, is also the problem of negotiating with the Japanese?

A That is right.

Q And I can put on the record a statement from the Japan Consul earlier in the Hearing that they buy coal from the Eastern United States at market prices and from Western Canada and Australia at production cost, so that Mr. Sabey and Mr. Patching both touched the point that I picked up last night and it is on page 1578 of the transcript which is a point that you raised Mr. Sabey about the price of coal at Hampton Roads and for the first four months of 1973 of a value of $20.26.

Q (continued) I know it is very difficult to get prices, recent prices, but generally speaking, I take it from your evidence, Mr. Boyd, that the McIntyre coal is of an equal quality to the better coals produced on the Eastern Seaboard of the United States, say compared to Pocahontas?

A Well, I would qualify it this way, that the Pocahontas has maybe one or two points better in ash. However, your McIntyre coal has, say, .4 sulphur compaired to .65 for the Pocahontas and from thereon you get into your swelling indexes and so on and so forth and it takes a real expert on coking coal to point out all the differences.

Q Well, I was thinking of that last night and I recall reading a paper that was presented to the 25th Canadian Conference on coal at Victoria on September 16th to 19th of this year and this paper is by Mr. J. J. Crabb, Vice-President of Exploration of Crowsnest Industries and this paper is entitled "Relating Coal Specifications to the Sales Contract".

A Yes.

Q And after having read this paper I can agree with what you have just said but fronting on page 15 of this paper is a table numbered 2 and the table is entitled "A Comparison of Actual and Quality Adjusted Prices for Two American, an Australian and a Canadian Producer as of July 1973 in U. S. Dollars", and without going through the mathematics, which as you say are rather obstruse and which I must say I didn't follow, the two American coals are listed at the higher price, this is laid down in Japan, Yokohama, or wherever the case may be, the two

1-LP-7
J. T. Boyd - Crump Ex.
- Stevenson Ex.

Q (continued) American run the highest price, then comes the Australian and fourthly at the bottom is the Canadian. And I notice at the bottom, they have a footnote which is an asterisk, Ocean Freight to Japan parenthesis assumed --

A Yes.

Q Because, of course, this means the state of the charter market?

A Right.

Q Which fluctuates badly and the nationality of the bottoms that handle it, there are many factors I realize, but it does give some relative comparison that to Japan from Roberts Bank in Vancouver, $4.50, from Port Kambla, that is K-a-m-b-l-a, an Australian port $4.50, and from Hampton Roads $9.50?

A Yes.

Q This is what one would expect handling it through the Panama?

A Right.

Q But it does seem to me it is a very favourable negotiating point for the Canadian producers?

A Yes, sir.

Q Particularly as compared to the Eastern American?

A Yes.

Q I have no further questions. Mr. Stevenson, have you any re-examination?

MR. STEVENSON EXAMINES THE WITNESS:

Q A couple of points, Mr. Boyd; the high ratio U.S. Steel was handling that Mr. Sabey mentioned, what did you indicate were the necessary conditions, conditions in which you could do contour stripping?

A Contour stripping, instead of a truck and shovel operation you say use a shovel and be able to stack your overburden or so-called spoil right next to the cut of coal you are going to mine out and you are only handling this overburden, say, a matter of 75 to 100 feet.

Q Just casting it aside your operation?

A Right.

Q And do those conditions exist in the No. 9 area as far as you can tell?

A It would be very, very low coal at that time.

Q Now the key I gather is the cost per cubic yard of removal of overburden?

A Yes.

Q And no matter what method you use you want to get that below 46 cents?

A Right. As I see the economics, your hauling and miscellaneous costs and loading are pretty constant and you have got to remove, your overburden is a key factor.

Q And do you understand it to be correct that the handling cost of Kaiser exceeds 60 cents per cubic yard?

A I would say that it would be in the high 50's.

Q I had that figure from one of the company's comments in September 1972 when they were discussing with the Japanese technical mission the No. 9 mine and there was a reference here N.K.K. and Kobe studied the cost of No. 9 mine based on previous presentations and on Kaiser's experience. The handling costs of overburden in Kaiser exceeds 60 cents per cubic yard. The study showed us that the f.o.b. cost will be not more than

Q (continued) $27 per long ton. Would that 60 cent figure be a reasonable estimate of what those costs were at that time?

A What date is that, sir?

Q September, 1972, about a year ago.

A Yes, that is the reason that Kaiser is operating at about a 5, 5¼ ratio.

Q Because of that cost?

A Yes.

Q And you were asked if you had seen any detailed plans for mining No. 9 strip, are there any?

A If they have them, I have not seen them and again to date I believe Mannix have been doing most of the strip engineering.

Q You have seen the Mannix reports?

A Yes.

Q And you have seen the Paul Weir Report?

A Yes.

Q And you are not aware of any others?

A No.

Q What cleaning ratio, what ratio of production cleaning tons do you expect from the strip operation in No. 9 area?

A No. 9 area I expect an over-all average of 65 per cent.

Q That is all I have.

MR. CRUMP: Thank you. Thank you for coming, Mr. Boyd, you may step down. We appreciate your efforts.

A Okay, thank you.

MR. STEVENSON: Thank you, Mr. Boyd. Dr. Barron?

2-HG-1
K. Barron - Stevenson Ex.

DR. KENNETH BARRON, SWORN, EXAMINED BY MR. STEVENSON:

Q Dr. Barron, you are employed by the Department of Energy, Mines and Resources of the Federal Government and, in particular, the Mining Research Centre operated by the Mines Branch in Calgary, is that correct?

A That's correct.

Q And what are your professional qualifications, Dr. Barron?

A I have a B.Sc. Degree in Physics and Mathematics, a Masters Degree in Physics, and a Ph.D. in Engineering.

Q From the University of London?

A That's right.

Q And how long have you been with the Mines Branch?

A Thirteen years, since 1960.

Q And what is your present position with that Branch?

A I am Manager of the western office of the Mining Research Branch.

Q And I understand that, prior to coming to the Mines Branch, you were employed by the National Coal Board on Mining Research in England?

A That's right, for two and a half years.

Q And prior to that you were in your studies, is that correct?

A Yes.

Q Now, are you familiar with the McIntyre Porcupine operations at Grande Cache?

A Yes.

Q And did you undertake a study for McIntyre Porcupine with respect to roof problems in the No. 2 and 5 mines?

A Yes, that's correct.

Q And did you also provide for this Commission a summary of the studies that had been undertaken by the Mining Research Centre, with respect to mining of thick and inclined coal seams?

A Yes.

Q And did you have general supervision of the studies made for the roof problems?

A Yes, at that time I was Project Leader of that area of work.

Q And did you prepare a report for the Commission?

A Yes.

Q And this was prepared under your supervision, Dr. Barron?

A Yes.

MR. STEVENSON: Exhibit 42, please.

REPORT PREPARED BY DR. KENNETH BARRON MARKED EXHIBIT 42.

Q MR. STEVENSON: Dr. Barron, what is the Mining Research Centre's interest in the mining of steep pitched and/or thick seam coal? Why has the Centre been involved in that?

A There are two basic reasons: Firstly, as you're probably aware, the Government is interested for a long-term energy planning in defining the mineable coal reserves of Western Canada, and since a considerable portion of these reserves

A (Continued) are tied up in thick and inclined coal seams, we are, therefore, studying means of mining these seams, particularly of mining them hopefully at a profit.

The second reason of studying them is that currently fully mechanized mining methods for these seams are few and far between and, consequently, we are looking to the future to try to review what is being done elsewhere in the world that might assist us in making our current theoretical reserves into truly mineable reserves.

Q And at the moment is it necessary to discount heavily the thick and inclined seam reserves?

A I think one would have to discount them considerably. In specific circumstances, they may well be mineable, but I think of the geologic reserves in Western Canada, something like 70 per cent could be defined as being thick and inclined and the bulk of that, I would say, would be unmineable economically at the present moment.

Q And outside of hydraulic mining, is there any significant prospect of economically developing some other kind of mechanical mining for use in these seams that we've been talking about?

A I think here we have to consider almost area by area. Of the studies that we conducted in France, the most economic method, which was for thick and flat lying seams, was a long wall foot wall slice with caving and drawing. This, I think, could be economical in Western Canada at about 40 foot thickness,

A (Continued) given reasonable ground conditions associated with this.

Q And that is in fairly level seams?

A Yes, less than 20 degrees.

Q And of any of the other methods that you've investigated, are any of the mechanical methods economically feasible in the steeply pitched areas today?

A I think not. One of the methods we studied in France was for normal thickness about 10 feet steeply inclined seams, perhaps, 45 degrees. This would be technically feasible. It would be possibly economically feasible if one had a ready access to backfill material. However, unfortunately, in the Rocky Mountains, local backfill material is exceedingly rare.

Q And are there any other prospects that have come to the attention of the Mining Research Centre?

A We are continuing our studies in this area. In particular, some time in the near future we will be looking at possibilities of short wall mining. However, it's completely premature to make any comment on that since we haven't started these studies yet.

Q I take it then that the only technological breakthrough that appears to have some prospect at the moment is hydraulic mining in steeply pitched seams?

A This certainly would seem to be the best prospect presently.

Q And in making your assessments, do you consider the thickness of the seam a factor in the prospects for hydraulic mining?

A Yes, I think, in general, the thicker the seam in hydraulic mining the better. I would think with the thinner seams your economics would be much tighter.

Q And what do you look at as being sort of an adequate or a thick seam, an adequate thick seam?

A Well, hydraulic mining, I don't think one could contemplate less than 20 feet thick, but this is not based on a feasibility study.

Q Are the present operations that are being conducted in Western Canada in 40 foot seams or --

A The only hydraulic mining at the moment is at Kaiser, where I think the seam thickness is something like 60 feet.

Q And now, I take it that the Mining Research Centre also, as part of its function, undertakes examinations for industry at industries' request?

A Yes.

Q In what circumstances, Dr. Barron?

A We will investigate problems primarily of ground control or of dust control, or environmental control underground at the request of mines, provided that the knowledge gained from that is useable to the general benefit of the rest of the industry. If it's a unique situation to a particular mine, then we feel that this is a job for a consultant and we would not be involved.

Q Now, you did undertake a study of the roof problems in No. 2 and 5 mines, which is essentially the first part of this

Q (Continued) report, Exhibit 42?

A Yes.

Q And on page 2 under "Structure", you make the point that there are small structural features which affect the mining, itself, not usually recognized during regional exploration. How do you learn of these problems, Dr. Barron? How can you anticipate them, or can you anticipate them?

A In most cases, your regional exploration drill holes will not indicate the fine structure of the rock or of the coal seam which is to be mined. Consequently, one has to wait either until one is developing within that seam or, perhaps, during the exploration stage have development added into the seam. This will give you more information. It's very difficult to pick out the fine structure from exploration drilling.

Q So that you have to get into your operations to determine these conditions?

A Yes.

Q And is that part of the justification for pilot investigations?

A This would be one reason, not necessarily the sole reason.

Q Would an experienced geologist in the area be able to anticipate the kind of problems that emerged in respect of mines Numbers 2 and 5?

A I think given the experience in the area and, particularly, of mining in other seams in that area, then geologists with a good knowledge of structural deformations of that area could

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A (Continued) make some fairly good educated guesses as to what problems might be encountered, and he would certainly have a good idea of what to look for and thus have a better chance of seeing this.

Q Your analysis was, I take it, that the conditions that were causing the roof problems in the No. 2 and 5 mines was caused by two geological conditions. What were they?

A Well, there are occurring basically throughout the mines systematic fractures striking in consistent direction in those of about 10 to 30 feet wide almost vertical, and these will occur in zones and there will be almost unfractured rock and then another zone. In extent they may be 20 feet to several hundred feet in extent. So you have these vertical fracture systems which we've called in the reports "Systematic Fractures".

In addition, you have very low angle thrust faults. These are slightly steeper than bedding. They come up through the coal sometimes following the bedding planes and then cutting off through roof strata, so that in effect on occasion you have this wedge formed by the thrust, which is then cut off by the systematic fracture system here.

In addition, in the No. 5 mine, which is not present in No. 2 mine, you have a mudstone above the cap rock, which has got a large number of curved carbon coated dewatered fractures, which these curved fractures have

A (Continued) little or no strength across them so that you have really a jigsaw puzzle of randomly oriented fractures in the mudstone above No. 5 seam.

Q Now, the conditions that you've mentioned, the two conditions that you first mentioned, the systematic fractures and the thrust faults, would you anticipate their presence in the Numbers 10 and 11 seams as well?

A Yes.

Q And throughout the McIntyre leased area or McIntyre operated area in all those seams, 4, 10 and 11?

A I think it's highly likely and I would think that any geologist going into any development would immediately start looking for evidence of their existence.

Q And what is the remedy, if there is one, for that condition?

A If you can mine generally from the most westerly direction to the most easterly direction, then you do come across evidence of these thrust faults in the coal. As you mine through it in the coal you can pick up evidence there which could give you some warning that you could have potential problems ahead of you.

If you are mining in the other direction, you get underneath this detached block, a block which is detached by the thrust faults before you see the evidence in the coal, so that from that point alone it is preferable to mine generally from the most westerly heading

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A (Continued) towards most easterly, but that may not be the, there may be other factors which would include the --

Q And if you are aware of the condition, you will support in the area you anticipate the problem?

A Yes, one would tend to, I think, timber or increase the density of support possibly to increase bolt length.

Q And this would require increased support in mining these particular seams?

A Yes, this would be possibly local increases of density.

Q And the condition of the No. 5 mine was aggrevated by the condition of the roof material as you have already described?

A Yes.

Q And are we able to anticipate the presence of that condition anywhere else?

A I am not sure of the lithology may be above No. 11. If the similar mudstone occurs there then there could be similar aggravations.

Q At any rate you can expect the two geologic problems that you have indicated?

A Yes.

Q And the solution for those is partially to direct your mining as you have indicated and then to increase the support?

A Yes, I don't think this is necessarily a solution. It's a means of minimizing the falls. I don't think one has an instantaneous solution.

Q And the method used of roof support itself, the roof bolting system, you don't find any fault with that as such?

A The roof bolting was doing the job it was asked to do I feel. Unfortunately when tied together a block of ground if that block is detached from the mass above then the bolting is not going to be effective.

Q And on page 5 of your report you illustrate --

A Illustrate one example where this, you could have potentially a safe looking situation which might be hazardous.

Q And the only solution in that circumstance is on your page 5, figure 2, is to support under block B?

A That's right.

Q And by timbering or steel arches or whatever it may be?

A Yes.

Q That makes for costly mining?

A It certainly would increase mining costs considerably.

Q Now, Dr. Barron, you have been in the No. 11 seam or examined the No. 11 seam at that point?

A Very briefly, yes.

Q There are presently operations to your knowledge in the No. 11 seam of the No. 2 mine area?

A I am sorry?

Q There are presently operations in the No. 11 seam of the No. 2 mine area?

A Yes.

Q And do you anticipate any difficulty or problem in the development in the No. 11 area from the fact that the No.4 seam below it is to be depillared?

A That's a difficult question to answer. Perhaps I should say this, I wouldn't like to presume there would be no interaction between No. 4 and No. 11.

Q And what effect that interaction will have is problematically, is that correct?

A Yes, conceivably in the last situation one could have badly disturbed ground in No. 11 seam as a result of mining, particularly if there is extensive depillaring in No. 4 seam. However, the extent and strength of the intervening strata will control how much influence there is. I don't think at this stage one could say either way how much effect there is

A (Continued) going to be on No. 2 on No. 11 seam.

Q You expect some interaction?

MR. SABEY: No, he didn't say that.

Q MR. STEVENSON: Oh, I am asking you if he does expect it?

A I think it is quite possible there will be some interaction.

Q Is it generally preferable to mine those kind of seams in ascending or descending order, Dr. Barron?

A From the ground control point of view generally it is better to mine in descending order.

MR. STEVENSON: Those are the only questions I have, thank you.

MR. CRUMP: Mr. Sabey?

MR. SABEY EXAMINES THE WITNESS:

Q Dr. Barron, I have just had a chance to look at your report this morning, and I apologize for any lapses that I may have in referring to it, and I hope you bear with me.

First of all your report seems to contain two aspects, and I think Mr. Stevenson dealt with them separately. The latter aspect is the summary of the studies on thick and inclined coal seam mining methods starting on page 11?

A Yes.

Q That was a separate report?

A That was, yes, separate report at the request of the Commission.

Q And that was subsequent in time to the first part?

A Oh yes, yes.

Q The first part dealing with the roof problems was at the request

Q (Continued) of the company and that was done when?

A It started in about November or December 1970.

Q And would have been concluded shortly thereafter?

A No, the documentation of roof falls went on to about June or July of '71.

Q I see.

A We had continuous studies since that time but the main documentation we thought we had enough evidence gathered in that time to complete the analysis.

Q Well, this report that is filed today --

A Yes.

Q Is a document that was prepared in the summer of '71?

A No, that specific report was compiled two or three weeks ago summarizing about three or four reports which were given to the company as our work progressed.

Q I see, and that would be over the period 1970-'71?

A Yes, and running into '72. Geological analysis took somewhat longer, and I think the report to the company on that was about 1972, mid '72.

Q Is there any reason that geological survey took longer?

A Mainly time commitments on our part.

Q Now, turning back to the second part on it, on the thick and inclined coal seam mining methods, your studies there, sir, were general in nature and not specifically related to the Smoky River coal?

A No, we were interested in western Canadian coal in general.

Q Including B.C.?

A Including B.C.

Q Now then turning to the first part of your report which deals with the roof problems at page 1 you say and I quote: after dealing with the engagement in the fall of 1970,

"It soon became evident that, as development progressed, the roof falls in No. 5 mine were becoming more frequent, this was not the case in No. 2; "

Now, do I take it from your evidence this morning you feel that the increased frequency in 5 as distinct from No. 2 was due to this mudstone in the cap rock above No. 5?

A Yes, I think this was a prime influence on the more falls in No. 5 than No. 2.

Q Yes, and you deal with really three problems as I gather your evidence it is fracturing, thrust falls and those compounded by the mudstone?

A Yes.

Q And you anticipate the first two problems in 4, 10 and 11, but not the mudstone cap rock problem?

A The mudstone, it depends, I don't know the lithology on it.

Q Now, sir, at page 6 in dealing with your 88 bolt tests you say in paragraph A

"The five eight inch diameter bolts used by the mine are quite adequate;"?

A They are quite adequate from the point of view they are strong enough. There is no point in having a bolt stronger than the anchor, and consequently when we tested failure we felt the anchor and there is no point in having a stronger bolt.

Q Sir, the report you gave to the company said, and I quote from your report,

"The five eight inch diameter bolts used by the mine are quite adequate; nothing would be gained by using more expensive three-quarter inch diameter bolts period."?

A Yes, sir, period.

Q Paragraph C you said:

"The main anchorage capacity from all bolts was 9.5 tons; this is quite adequate for this strata."

A Yes, in other words --

Q Well, sir, I am not asking for an explanation, is that what your report says?

A Yes.

Q Now, if you have an explanation that is fine.

A No, just to amplify that point, the 9.5 ton anchorage capacity on the bolt were, with reasonable bolt spacing should support a roof adequately.

Q Thank you. In paragraph D, the final sentence you said,

"Strata reaction to bolting will vary throughout the mine, thus bolt spacing should be modified in accordance with local conditions."

A Yes.

Q Paragraph E,

"The six foot anchorage horizon used by the mine seems quite suitable; no great advantage would be gained by using the other horizons tested."

A Yes.

Q Now, is that consistent with what you have just said to me now?

A I think it is consistent. When I said six foot horizon is quite adequate I mean the anchorage capacity at that horizon is quite as good as that of the other horizons. And from that point of view the anchorage capacity is quite adequate at that horizon.

Q I see, but sir, when we talk about a six foot horizon you are talking about six feet in length of the bolt?

A That's right.

Q But, sir, I gather from what you said earlier in talking, the evidence of Mr. Stevenson that there may be a situation arise as you have shown in figure 2 whereby a longer bolt would go through this and would get the more secure horizon?

A Yes, if one can predict that.

Q Yes, and one cannot?

A I think this, as I tried to indicate to Mr. Stevenson, depending on the direction in which your mine, if you can pick up the evidence of the thrust faults from the coal then one has some idea that / one will encounter this thrust fault above or further ahead.

Q Yes.

A And in that case perhaps it would be worthwhile putting a drill hole to locate the existence, and in that case if one can do it then one would anchor above that horizon. Now in saying six foot horizon here I was referring only to the anchorage capacity of that horizon.

Q I see, so you would amend or expand on that when you said it seems quite suitable, that is subject to what you have just said today?

A Yes.

Q Thank you. F:

> "The type C1 shell, used by the mine, behaved as well as or better than all the other shells tested having a mean anchorage capacity of 11.1 tons."

A Yes.

Q And paragraph G, the first sentence,

> "The torque tests on randomly selected bolts showed that most were effectively installed and should hold substantial loads,"

and then you go on to say that some of the older bolts were loose and the more recently installed were not loose and they should be checked periodically?

A Yes.

Q And then you dealt in paragraph H with what you categorize as a number of minor, but important, changes in installation procedures, --

A Yes.

Q -- and do you know if those were implemented?

A To the best of my knowledge they were implemented.

Q And then, sir, at page 7 you summarize in your conclusions really the same points that we have just gone through?

A Yes.

Q In paragraph number 8 of your conclusion you said and I quote,

Q (Continued)

"In general roof bolt installation procedures were good; to maintain these standards emphasis should be placed on training any new roof support crews in good practice."

A (Witness nods)

Q And then, sir,over the page 8, you said and I quote,

"In such complex roof strata it will probably never be possible to entirely eliminate falls of roof rock."?

A That's correct.

Q And then you go on to make the same point that you just made by watching the strata you might be able to accommodate for it?

A Yes.

Q Sir, I want to turn to this question of this interaction between seams 4 and 11. That is some 360 feet apart generally as I understand it?

A Yes.

Q My first note of your first statement is that you would not like to presume there will be no interaction?

A Yes, that was --

Q I guess, sir, is it fair to put it conversely, would you like to presume that there will be interaction without knowing what the intervening strata is?

A I don't think that I can,at this stage, one can predict whether or not there will be interaction.

Q But to be cautious you have to assume there might be?

A To be cautious one I don't think should ignore the possibility whether there will be interaction.

Q Quite, thank you. Sir, I apologize, I would like to turn back to your very general discussion again, and you heard the question put to Mr. Boyd this morning --

A I heard some of it, yes.

Q Yes, sir. Mr. Boyd agreed when I suggested to him that today's industry is mining coal that couldn't have been mined 20 or even 10 years ago whether due to improved techniques, equipment or simply economic conditions, and I gather you would confirm that as well, sir?

A Yes, I think so.

Q And, sir, in your view is it equally possible the same can be said of today some 10 or 20 years from now?

A Yes, I think this would be the case.

MR. SABEY: Thank you very much, Dr. Barron.

MR. CRUMP: Thank you, Mr. Sabey. Mr. Patching?

MR. PATCHING EXAMINES THE WITNESS:

Q I have a couple. Just for my benefit, and perhaps for the others, can you tell us what de-watering fractures are? A term I haven't heard before.

A De-watering fractures, I am told by a geologist, not being an expert myself on this, that within this mudstone in the roof there are some coal lenses which he attributes to being almost individual logs from which during compression of the sediments these have been de-watered and you got these curved de-watering

A (Continued) fractures. This is the source of what he deems to be these fractures. Not being an expert I couldn't say this. The end result is, however, that we have coming from these lenses, from the lenses a series of these curved carbon coated fractures.

Q Thank you. A couple other questions, in the report you have described several methods or referred to several methods of mining thick seam studies overseas. Can you give us any idea what the percentage recovery of coal might be by these methods?

A Yes, I think I can. In the, let's go through it with reference to page 11 of the report. Method A, for seams inclined up to 50 degrees, this is a longwall method of the panel extraction would be probably 90 per cent. The overall recovery, I am not sure, perhaps 70 per cent.

In the thick, very thick seams with the caving and drawing the panel recovery sometimes exceeds 100 per cent by drawing over panels. The overall recovery seems to be about 90 per cent.

In, the same method in steeply inclined seams, this is from memory, I believe it runs about 65 per cent recovery.

Method C, I am not sure on this, but I would think around 60 or 70 per cent recovery, and method D runs about an overall recovery of 65 per cent.

Q And concerning hydraulic mining, do you have any information on the quality of roof that is required for successful hydraulic mining?

A We have no information at all on that at this moment. The only hydraulic mining is that at Kaiser and very little is known about the roof as it is completely inaccessible.

Q I wonder if you thought the roof conditions that would be suitable for hydraulic mining might also be suitable for the Canadian methods you have described?

A I think there would be a lot of parallels between the two methods in this case in that the roof conditions will control the amount of dilution in the caving and will also control the load coming ahead of the face. If the roof hangs up and doesn't cave then you can have bad face conditions due to the abutment load ahead of the face. If the roof caves well then the face conditions are generally improved. If it caves too well you can get some dilution of your coal.

Q Would you think that perhaps if the roof caves well it would not be suitable for hydraulic mining because of pollution?

A I think with hydraulic mining one might well have a similar solution but this would depend on the density of your rock materials, whether the water would flush out the rock in the case of hydraulic mining, it may just flush the coal and leave the rock behind.

Q That is all, thank you.

MR. CRUMP: Mr. Graham, have you any questions?

MR. GRAHAM: No, thank you.

MR. CRUMP: I have none. Thank you very much for coming, Dr. Barron. Oh, if you would wait for a moment, Mr. Stevenson, I overlooked any re-examination on your part.

MR. STEVENSON EXAMINES THE WITNESS:

Q There were just two points in fact I have missed in my first list. Dr. Barron, does the Mining Research Centre staff have any jurisdiction or authority over the operations of the management of mines in the province?

A None whatsoever.

Q And does it purport to make judgments about the quality or suitability of technical work for installations?

A Only unless if particularly requested by the mine.

Q And I gather from what you said that you were satisfied that the roof bolting method used by McIntyre was a sufficient method except for these special conditions?

A Yes, we examined the efficiency of what they were doing and what they were doing in techniques was quite adequate.

Q Would you have recommended any other method of support?

A I would have liked and would still like to see some support trials of variations of supports in this mine.

Q Would regular observation as to development headings for these geological structural hazards that you have mentioned by a staff geologist be advisable?

A I think we strongly recommended that to the company.

Q And is it practical to have structural geological studies made before laying out the mine development that would deal with the kind of problems we are concerned with here?

A It would be very difficult to pick up the potential problems very early until one is into the development.

Q That is fine. Thank you, Doctor.

MR. CRUMP: Does that conclude your examination?

MR. STEVENSON: Yes.

MR. CRUMP: Thank you, Dr. Barron, you may step down. I think this would be an appropriate place for a 20 minute recess.

(The Hearing stood adjourned at 11:00 a.m. and reconvened at 11:15.)

MR. CRUMP: Would you call your next witness, Mr. Stevenson, please?

MR. STEVENSON: Mr. Wardell.

KENNETH WARDELL, sworn, examined by Mr. Stevenson:

Q Mr. Wardell, you are the senior partner in a partnership of consultant mining engineers and geologists operated under the name of K. Wardell and Partners, is that correct?

A That is correct.

Q And would you outline to me your professional qualifications in the field in which you operate?

A Yes, I hold a degree of a Master of Science in Mining Engineering, University of Nottingham; I am a Member of the Institution of Mining Engineers in the United Kingdom; I am a Member of the Institution of Mining and Metallurgy; a Fellow of the Geological Society of London; a Member of the British Institute of Management and a member of various other professiona bodies and associations including The Societe de l'Industrie Minerale in France.

Q Mr. Wardell, your work is in underground mining of all types, is that correct?

A Yes, but predominantly in coal mining.

Q And I take it that since 1959 you have been connected with operations of coal mining in France, is that correct?

A Yes.

Q What is your position in that regard?

A I was appointed in 1959 as consultant to the State Coal Mines of France on problems connected with their ground control, with the design of longwall operations and with general mine design.

Q And is that a continuing appointment?

A That is a continuing appointment. And also in France with the State Potash Mines which are located in the Province of Alsace.

Q And I understand you have also acted as a consultant for the World Bank?

A Yes.

Q In what projects?

A Principally in a major coal mining project in Bihar in India.

Q And advising in what respect?

A Advising first of all on the basic feasibility of a very large project including the construction of two completely new coal mines and the reconstruction of an existing one, and then participating on behalf of the World Bank in the major planning and programing and scheduling operations to make sure that the Bank's money which had been invested was being spent wisely and

A (continued) well.

Q And that included at the outset feasibility during operations?

A Surely.

Q And is that a continuing responsibility?

A That is a continuing responsibility.

Q And I understand you are also a consultant to the British Steel Corporation, in what respect?

A The British Steel Corporation since the embargo was lifted on the importation of coal into Great Britain, some three years ago, has been purchasing supplies of high-grade metallurgical coal, seeking supplies of high-grade metallurgical coal from various companies, but the Steel Corporation had no coal mining engineer employed permanently on its own staff, so I am employed to advise the Steel Corporation in this respect. Generally speaking what this amounts to is looking at particular projects which are brought to the Corporation's attention from the point of view of supplies, either the Steel Corporation itself gets to know of these or potential producers bring them to their notice, of the Steel Corporation, and then it is my function to look at the properties, to examine the feasibility of them and to advise the Corporation on whether it can satisfactorily and safely either enter into a contract to purchase or even in certain circumstances whether it would be advisable to invest in particular projects.

Q And is that a continual assignment?

A That's a continuing assignment.

Q And has that work or any of that work brought you into Canada?

A Yes, my work for the Steel Corporation, in fact, has been predominantly in Canada with some excursions of a general nature in Australia and of a particular nature in the United States.

Q And have you familiarity with the Canadian mining scene in respect of the Rocky Mountain mining area other than in connection with the matter that you were instructed by this Commission?

A Yes, I first became involved in underground mining in Western Canada in about 1963, or when I was invited to advise the then Crowsnest Industries, firstly, in an arbitration which was being pursued as between them and the Alberta Natural Gas Company; and subsequent to that, on the layout and design of certain new underground mining operations which they were then proposing to meet a long-term contract to the Japanese for the supply of metallurgical coking coal.

Q And does your work include the assessment of reserves of the, of the assessment of economic reserves of coal?

A Yes.

Q And your basic experience is in underground mining?

A Yes, indeed.

Q And have you had occasion to give expert evidence in relation

Q (Continued) to mining operations, their feasibility and conduct?

A Yes.

Q Where, Mr. Wardell?

A The description you give is a rather broad one, the feasibility and conduct, and so if I may take it on that broad basis:— in the United Kingdom, in Canada, and in Australia.

Q And has your evidence been accepted as expert testimony in those jurisdictions in those matters? I don't mean they have necessarily agreed with you, but have they accepted this expert evidence?

A It's a word I dislike very much, sir, the word "expert". I suppose the best thing I can say is that I have given evidence as an expert.

Q And you are presently on an assignment giving expert evidence with respect to mining operations before the Australian Royal Commission, is that correct?

A That's correct.

Q And you also gave evidence before the Aberfan Inquiry in England, is that correct?

A That's correct.

Q And what was your instruction here, Mr. Wardell? What instructions did the Commission give you here? What were your terms of reference here?

A I don't think my terms of reference were in fact very strictly defined. I saw, of course, the Commission's terms of

A (Continued) reference and I discussed how I may assist with the Commissioners and, generally speaking, I believe it was my suggestion that I should look at the history of the McIntyre Porcupine operations prior to the commencement of underground mining proper, then look at what had happened during the period of operations from the commencement to the present time, and then offer whatever comments and observations and analyses I could in respect to future underground mining.

Q I understand, Mr. Wardell, that you are the author of a number of articles in recent years on mine operations, is that correct?

A Yes, my, one of my principal fields of interest is that of so-called rock mechanics, which means the support or of the mine workings or problems of ground control.

Q And you have given papers in Canada on underground coal mining in steep and thick seams and in mine design?

A Yes.

Q And in the United States on effects of mineral and underground excavations on the overlying ground surface, is that correct?

A Yes, that's correct, and also in the United States of the ground control implications of long wall mining.

MR. STEVENSON: I am offering Mr. Wardell as an expert witness to the Commission in connection with an evaluation and assessment of the underground mining in the

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MR. STEVENSON: (Continued) McIntyre Porcupine Grande Cache development.

MR. CRUMP: Mr. Sabey?

MR. SABEY: Mr. Chairman, with some trepidation I arise. I do have one or two questions, Mr. Wardell.

MR. SABEY EXAMINES THE WITNESS:

Q You've outlined a very broad and demanding schedule of continuing obligations in many areas relating to the mining. I'd like to really deal with that relative to the Rocky Mountains of Western Canada. You say in '63 you were involved in a Crowsnest Industry arbitration with the gas company?

A That's correct.

Q What was the nature of that arbitration, sir?

A The Alberta Natural Gas Company had, with the consent of the then National Energy Board, laid a natural gas pipeline three feet in diameter a thousand psi pressure passing through it over an area of potential or believed coal bearing lands belonging then to Crowsnest Industries, and the question was whether if mining took place it would adversely affect the stability of that gas pipe line, and if it would, what restrictions that might impose on the underground mining either totally or partially. So my --

Q What the damages might be?

A Not, I think not so much your question of what the damages might be, but how damage could and ought to be avoided.

Q But this was before the pipe line was built?

A Oh, the pipe line was already constructed but the mining hadn't begun.

Q Quite, I see, and is that it, sir?

A Only to say that my particular terms of reference were to discuss the effects of mining, underground mining on the pipe line if it was to be pursued without any concern for the existence of the pipe line, and if it had to be pursued with proper concern for it, how the mine workings should be developed and laid out and what the consequential effects of that would be in terms of mining operations.

Q Right. You were then engaged to consider the layout and design of underground operations, or are these the same?

A No, this was a subsequent completely different assignment.

Q With?

A With Crowsnest Industries.

Q And when was that?

A This would be in 1964.

Q And did you do that?

A I did.

Q And did you oversee the layout of the mine?

A I did.

Q And how long did that continue, sir?

A Until the company or the major coal mining interests of the company passed to Kaiser Resources, which would be until about

A (Continued) 19 -- I can't remember exactly the date, 1967 or '68.

MR. SABEY: Mr. Chairman, I shan't develop that at this time because I don't think the obvious questions in that respect go to qualifications and I may raise this later.

MR. CRUMP: That may be developed in your cross-examination.

MR. SABEY: Thank you. Thank you, Mr. Chairman.

MR. CRUMP: Thank you. Mr. Stevenson?

MR. STEVENSON FURTHER EXAMINES THE WITNESS:

Q Mr. Wardell, you personally prepared a report for the Commissioners, is that correct?

A That's correct.

Q And is this, was this work done by you?

A Yes.

Q And you prepared a report in relation to the terms of reference of the Commission, and is this a copy of that report, the original actually of that report?

A Yes, that's the original.

MR. STEVENSON: Mark that as Exhibit 43.

REPORT PREPARED BY MR. K. WARDELL MARKED EXHIBIT 43.

Q MR. STEVENSON: I understand, Mr. Wardell, that you broke your study down into three parts: an examination

Q (Continued) of the mining development 1964 to 1969, then the operational phase of the mine, and the future prospects of the mine, is that correct?

A So far as underground mining is concerned.

Q Yes, your terms of reference did not include strip mining operations?

A That's correct.

Q And you haven't made any recommendations or suggestions or assessments with respect to the strip mining potential?

A No.

Q Now, I understand, Mr. Wardell, that you reviewed the basic policy decisions that led up to the making of the Japanese coal contract in about 1968, the middle of 1968, execution in early 1969?

A I think, perhaps, what I did, rather, if I might put it in my own words, is reviewed the information that was available to management as a basis of decision making.

Q Now, the critical decision would have been the 1968's contract with Japan in this period?

A Yes, indeed.

Q Up until that time there was no commitment to proceed with any kind of development in that area, is that correct?

A To the best of my knowledge that's correct.

Q And in order to assess the information that was available at the time that that decision was made, what information did

Q (Continued) you look at, Mr. Wardell?

A I looked at the various reports which had been prepared on behalf of the company at various times between October, 1963 and going as far as, going into the period of operation slightly, that's to August, 1969. They were reports and feasibility studies.

Q Now, at what various points could you come to a position to assess the economic mineability of reserves? Was this assessment made on a number of occasions by the company?

A Well, not always by the company, but by people advising the company. I think the principal reports, which went to the question of economic feasibility of underground mining, were, first the Landes Report, which, however, treated the matter rather superficially. Then there was a report by Mr. Gardener, which went into rather more detail about mining methods and costing. There were two reports by the Paul Weir Company of Chicago, one made in December, 1965, and one in September, 1967, which dealt very fully with the question of reserves and mineability and cost.

Q Would the 1967 situation be a convenient place to assess the information that the company had? Did you make an assessment at about that time?

A Yes. I have to, with some little difficulty, because the reserves are dealt with in the first section of my report and the questions on mineability and cost are in the second

A (Continued) section, so I might have to go from one to the other.

Q Do you want to review the reserve estimates without looking, separately from the cost estimates and then bring the two together, Mr. Wardell?

A I think this might be easier for me, sir, to do it this way.

Q All right. Would you like to review the reserve estimate calculations and information that the company had?

A As at 1967?

Q Yes.

MR. CRUMP: Is this on page 42?

A It's on pages 17 and 18.

Q MR. STEVENSON: Yes, pages 17 and 18, is that correct?

A Yes. I should say that this report by the Paul Weir Company was referring to areas which were predicated for underground mining. It wasn't looking at the broad picture of coal in the ground in the whole of the Smoky River area.

Q The Paul Weir Report and the studies at that time, up to that time, were all directed towards underground operations, weren't they?

A Yes, indeed. There was, perhaps, in the 1967 Weir Report, the first mention of the possibility of strip mining. There was an indication that there was not enough information generated at that stage to include it even as a possibility.

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Q All right, then on pages 17 and 18 you developed the information that was available to the company at that point, is that correct?

A That's correct, and at that time, the Paul Weir Company were looking at the coal contained entirely between the Smoky River in the east and Sheep Creek in the west and the Muskeg fault in the north and the very steeply dipping measures to the south, and this was an area shaped rather like a truncated pyramid and covered about 35 square miles.

Q It included Numbers 1, 2 and 3 mine areas?

A Yes. Perhaps, I may say that right from the beginning, Landes had divided this area into a north, the middle and southern sector and similar location by a number of mines had been made in these sectors. Perhaps, for simplicity, I could say that the No. 3 mine, which is still so-called, is in the northern sector and is the main mining area in the northern sector. No. 1 mine is still the main underground mining area in the southern sector. So the figures that the Weir Report was given this time were for the No. 1, No. 4 seam but No. 1 mine. I give two sets of figures here comparing their 1965 and 1967 reports. So, in reality, we are looking, since you mentioned the date of September, 1967, at the second column of figures. And they gave recoverable raw short tons in No. 4 seam at No. 1 mine at 10 million; in No. 4 seam at Numbers 2 and 4 mines at 12.8 million; and in No. 3 mine No. 4 seam at 7.3 million; for a

A (Continued) total of 30.1 million recoverable raw short tons.

Q And on page 18 you convert those to clean long tons?

A That's correct.

Q To give 20.3 clean long tons, 20.3 million clean long tons in the September 1967 report?

A Yes, and the conversion figures to clean tons, the figures that were then being used as the likely yields from the preparation plan.

Q And those reserves were indicated as being adequate for 8 to 10 years at two million tons?

A That's correct.

Q Now, can you comment on the adequacy of those, or the accuracy of those reserve figures at that time?

A I think in the terms in which the calculations were made, the calculations were accurate in the narrow mathematical sense. The problems arose because No. 4 seam at No. 1 mine was in an area of a very steep pitch, as was No. 4 seam at No. 3 mine, and the only reserves in those figures that are moderate pitch were in the No. 2 combined with No. 4 mine area. But, nevertheless, they were projected plans for mining, particularly in the No. 1 area by, partly by unmining, partly by continuous miners, and partly by long wall.

Q That's in the No. 1 mine?

A That's in the No. 1 mine.

Q And were there plans for the way the mining would be carried

Q (Continued) out in the No. 3 mine at that point?

A No, I'm quite sure I have never seen any plans of a formal, or in the sense of the word, that nothing was put down on paper as to how it would actually be mined for the No. 3 mine area. So this would be regarded as a potential mining area.

Q Now, was -- all right, do you want to comment further on those reserve figures, Mr. Wardell?

A No, I don't think so. The figures were quite clear. The assumptions on which the figures had been drawn were fairly clearly stated.

Q At that time, did the company have technological information to indicate how the No. 1 and 3 mines would be mined at an economic rate of recovery?

A It's an exceedingly difficult question to answer. Looking at --

MR. CRUMP: Mr. Wardell, please don't hesitate to elaborate on your answers --

A Yes.

MR. CRUMP: -- because it's the Commission that is looking for information.

A Thank you, sir. I think the problem essentially arises in this way, that one can look at any coal deposit in the ground and predicate some method of working it. There is every conceivable type and variety of coal deposit known has been mined somewhere in the world at some time. So there is never any fundamental difficulty about saying no matter whether the

A (Continued) coal is flat or stands on end or is a hundred feet thick, or indeed even down to 18 inches thick, there is no fundamental reason why it cannot be mined, and there is some way, some known way, with existing technology of doing this. The problem is you can apply the technology. It's like most of engineering, you can engineer most things; it's only a question of what does it cost to engineer it, and in order to arrive at cost you apply some system to a particular set of conditions that you have coal in the ground, but you have then to make some fundamental assumptions about how well you can perform the particular operations that you have in mind, and this is where the real difficulty arises because if you're facing a set of conditions that haven't in any way been previously mined, you have not a strict analogy from any other country or any other coal field. You are forced, in a way, into making unverified and basically unverifiable assumptions.

Q All right, would you develop that in relation to the information that was at hand and was being assembled as the commitment for the long-term Japanese contract was ultimately made?

A Yes. It's fairly clear that at this particular point in time, in 1967, the best developed systems for highly mechanized underground mining were the system of using of Room and Pillar Mining with continuous miners and shuttle car and belt

A (Continued) transport developed very largely in the United States on the one hand, and the Longwall System which had been highly mechanized and the developments had largely taken place in Europe and, particularly, in the United Kingdom. These were the two principal options, in the broad general sense, which were open for mining seams at relatively low pitch, and I think it's, I don't necessarily believe this is an absolute figure, but I think the figure of 20 degrees, somewhat arbitrary though it may be, is a useful one for the sake of drawing a line and saying that the highly mechanized room and pillar system, as it had been developed in the United States and applied to some extent also in Southern British Columbia, had shown that this equipment lost its mobility once depth of the seams approached 20 degrees, and as soon as it began to lose its real mobility, then productivity fell away and costs automatically rose, so this put a kind of limit on the applicability of that system in any particular set of conditions.

So far as long wall mining there was concern. This, without question, had had its major successes in flat lying conditions, and at that time, there were very few examples of the application of long wall on gradients of more than 12 or 14 degrees. I could certainly say that in the United Kingdom, you could have counted the number of examples where long wall was being worked on gradients in

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A (Continued) excess of that on the fingers of one hand. There were one or two examples in Germany, where the Longwall System was being applied on fairly steep gradients, but with rather dubious and uncertain results in terms of productivity and costs.

A So these were the two broad options open at this time in looking at underground mining in this area.

Q Then, how do you assess the prospects for the recoverability of these reserves that were under consideration in 1967?

A Well, there were, traditional yardsticks were used. The traditional yardstick with respect to room and pillar mining which was used by many many engineers, but very much a rule of thumb was that 50 per cent of the coal in place by volume was recoverable, and that figure was applied, but it derived largely from general experience in the United States in particular.

Q Would that be a satisfactory method of making these assessments at that point?

A Short of sitting down and drawing very detailed plans about exactly how one would mine and what areas could be extracted and what areas might have to be left in terms of ground control I don't see that there was a very much better yardstick although there had been a survey made by Laurie in the United States of 200 mines which did broadly indicate that the thicker a seam was and particularly once it got over 8 feet in thickness, the lower the rate of recovery was likely to be.

Q Because you were mining coal in coal?

A Surely.

Q And that time the maximum thickness of seam you could take out was what?

A By traditional room and pillar methods with the continuous miners, approximately 12 feet.

Q And what thickness of seam was the No. 4 seam that we were looking at here?

A Twenty feet plus.

Q All right, going on from page 18, Mr. Wardell, the next page there is a comment by Mr. Hulbert in respect of some exploration and examination that he did?

A Yes.

Q In which he says -- in which you say, the general conclusion was drawn that the area was underlaid by an immense field and there were almost certainly sufficient reserves to fulfill any size of sales contract which may be contemplated. What can you say about that statement as made then?

A Well, if you could simply relate the size of a sales contract to the quantity of coal in the ground that was a perfectly true statement; but if you had to relate the sales contract to what could be mined economically then it began to look a very doubtful statement.

Q Then what was done to improve or assess the recoverability mineable reserves in working towards the making of the contract? We have only got 20.3 million tons in September of 1967 with you indicate some doubt about the method which would be used to mine Numbers 1 and 3?

A Yes.

Q Was the company aware of that doubt at that point --

A Oh yes.

Q -- Did the feasibility studies show this?

A There were higher costs predicated certainly for No. 1 area and

A (Continued) I think it was generally appreciated that, I don't think there was any question it was fully appreciated that the problems of mining thick seams were much greater than those of mining flat ones, and that there wasn't a great deal of experience to use as a guide.

Q All right, and then you move on to in your report to making some further assessments of the reserves in 1968 and 1969?

A Yes.

Q What information did the company and what was it using in making its projections for the long term contract during that period of time?

A I think it's appropriate perhaps to come to the date of August 1969 which is after development had begun in certainly No. 4 seam at No. 2 mine, and to reference to reservesgiven in a report prepared by the company which was dated August 1969, which was prepared as I understand it for the information of a Japanese delegation; and apart from the references, of course, to the very large quantities of coal in place they made a specific reference to those reserves which at this time they considered to have a reasonable prospect of being mined at an economic cost, and these are summarized at page 23.

Q We have a total on page 23 of 58 million recoverable tons?

A That's correct.

Q Now, as of that time, as of the time that this presentation was made in what areas was it intended to produce this coal for the Japanese contract?

A There was a production schedule for the 15 years of the contract which was prepared in the same report of August 1969,

A (Continued) which is given at page 72.

Q That is initially mines No. 2 and 5 and then later 3 and 1 or later 3 and initially 1?

A And initially 1, yes. And in seams or numbers 4 and 10 of mine No. 2, seams 4 and 10 at mine No. 5, seams 4 and 10 at mine No. 3, and seams 3, 4 and 9 at No. 1 mine.

Q And what comment do you make on those reserve figures now that we are into the contract period?

A Well No. 10 seam of course hasn't been worked at all, nor has No. 3 mine or No. 1 mine other than the driving of some headings.

Q I am sorry, Mr. Wardell, as of the information that was available in 1968 and 1969 what comments can you make about the reserves that are given?

A I think it's probably necessary to turn back a couple of pages to page 70 which I think schedules, the reserves on which that production schedule is predicated.

Q That is page 70?

A Page 70, yes.

Q Yes?

A And recollecting that we were looking at No. 2, No. 5, No. 3, and No. 1 mines which were the first four of that table.

Q Yes?

A And over those total reserves that are shown on that page there were only 12.582 million which could be classified as proven low pitch coal. So the rest were either not proven or were at moderate to high pitch, and we therefore to that extent

A (Continued) less certain from the point of view of recoverability at an economic level.

Q From your analysis at that point, which would be August of 1968, after 10 years of exploratory field work --

A '69.

Q -- '69, after 10 years of exploratory field work what were the -- what would your comments be about the ability to perform the 15 year 29 and a half million ton contract?

A In relation to the coal that was then proved and where there was a reasonable expectation of mining at an acceptable level of cost my conclusion would have been that there were not sufficient reserves to sustain the contract either in terms of its total time and total tonnage, or in terms of the annual outputs predicated.

Q And is that based -- what is the justification for that or the basis for that?

A Simply that if you only have 12 million tons of coal in two areas which are proved low pitch and, therefore, where you have the best expectation of mining at an economic level of cost, and anything else you have is at a lower expectation than that and may in fact prove not to be mineable at an economical level of cost, you don't really get into a contract to do something which you have fairly sincere doubts about whether you can do.

Q Now --

A Not at any rate without some qualification with the people you are making the contract with.

Q Now, there have been analyses and studies done by the company prior to entering into the contract. Are you in a position to review those analyses or those later analyses with a view to pointing out where the company was in position to see or anticipate the problem that you have mentioned, mainly that there was only 12.582 million proven low pitch coal, and that was all that was then economically in a position to be guaranteed or dedicated to the contract. What were the assumptions that appeared to have been made or relied upon or the calculations that were made or relied upon that would justify going to a 15 year two million contract assuming these reserves existed?

A I think the assumptions were necessarily that some method would be found that time and human ingenuity you would result in some methods being found either to work these steeply pitching areas at an economic level, and that since the reserves were so vast it was almost impossible to conceive a situation where you couldn't find something that could be worked at at an economic level even though those areas which at this time were being exploited hadn't revealed such areas but there was still considerable areas to explore on the western side of Sheep Creek and to the south of, to the southwest in the Grande Mountain area towards the Town of Grande Cache.

Q In 1967 or 1968 was there any technology available that indicated there could be an economic development or mining of the steeply pitched areas at that time?

A On the basis that one has to move backwards from the realization that one gets from the contract and subtract that from that

A (Continued) a known, or at that time a known cost of inland freight, you come back to a free on rail cost at the site and my recollection is that on the calculations and the figures that were available then this was an 11 dollar a ton cost which had to cover the cost of mining, the cost of preparation, the cost of interest, and amortization and all the other things; and it seems to me, and I have to say that I probably speak to this point with some of the wisdom of a hindsight, that if one looked at what was known about mining in these steeply pitching areas in southern British Columbia and in Europe or elsewhere with the existing technology and with the existing levels of productivity that were then available that that was a virtual impossibility.

Q Now, let's look at the situation without benefit of hindsight, look at the financial analysis that the company had, and the assessments it had when it made its projections in 1968 or thereabouts, which I think you refer to at pages 63 and 64 paragraph 2 point 68.

A Yes.

Q The assessment that you make there was predicated on the information that the company had?

A Yes.

Q And what was your comment on their projected operating costs of recoveries at that point?

A Well, I think they rested primarily on a number of interlinked requirements or assumptions about the underground mining. It required that the longwall operations could be performed, I won't use the word successfully because it's a bit meaningless

A (Continued) in the context, but would perform on a productive basis.

Q Was there any reason to doubt that?

A Yes, there were reasons to doubt that, and would you like me to elaborate on that point at the moment?

Q Yes?

A At this time, '68 or '69 the longwall system had been used extensively in Great Britain and in other European coal fields, and had resulted in something in the order of an 8 per cent per annum increase in productivity in looking at the United Kingdom as a whole. And there was seven operations which in ideal conditions had a very high level of productivity. In Britain at that time there was single longwall installations which were producing as an average over a long period of time, a year or more, 600 - 700 tons per shift. But the average, if one looked at a coal field, particular coal field or particularly if one looked at the whole country, was a great deal lower than that, and was somewhere in the order of 270 or 280 tons per shift, which was far better, of course, than had been obtained by ordinary hand mining methods and which was the reason for the 8 per cent per annum increase in productivity; but there were no figures in Britain at that time, other than the quite exceptional circumstances to justify putting a high level of shift productivity from a longwall. At the same time longwall mining was beginning to be applied in the United States, and I want to be sure I am correct to the nearest two or three installations, but in 1969 I think there were about 20. Some of those had operated exceptionally well

A (Continued) with higher productivities than anything that had been achieved in the United Kingdom, but by the same token there had been four or five complete failures where the equipment had been put in and it had to be taken out again, and there was certainly no clear and definitive understanding at that time as to why some situations were total failures, and some were resounding successes, and others performed at an average level. And it seems to me that the predications that were made for longwall mining here were at the higher level of British achievement, and not at the average or at the worst, and that since these only occurred in quite exceptional conditions where everything worked absolutely smoothly and like clockwork it was a bit venturesome to suggest that what could be obtained in the best British conditions they could be obtained here in Rocky Mountain conditions which seems to me on any comparison of the geological and the physical circumstances were quite quite different.

Q So the first thing you mentioned is that the longwall system had to work --

A Yes.

Q -- over the other factors?

A Well, the longwall system itself couldn't be installed until a certain amount of development work had been done in the seam, the necessary entries had to be driven in order to block out a section of coal which would then be mined longwall, and the intention was to use continuous mining equipment to perform this particular operation.

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A (Continued) Again, in the United States this meant that you had to predicate some figure of performance for these machines in these particular conditions, and in the best conditions in the United States it's perfectly possible to get out of a modern continuous miner, supplied by shuttle cars and belt transport operating highly efficiently with skilled labour, good supervision, six to 700 tons per machine shift, exceptionally over that; but if one speaks of an average over a considerable period of time, a year or more, 600 would be the better figure, the upper quartile of the range if I can put it in those terms, but the average is much lower than that, and there are many many mines in the United States operating continuous miners on development work either for longwall or for ordinary room and pillar extraction, which perform at around 250 or 300 tons per machine shift.

Now this is, of course, a generalization because it doesn't take into account so many factors such as seam thickness and the nature of the roof and the extent to which it has to be supported, the nature of the floor and so on. So what I am really trying to say is give an indication of the range that down at the bottom is something in the order of 250 tons machine shift, at the top is something in the order of 600 tons of machine shift. And the problem here was to decide in looking at this project which particular point within this kind of range one would predict that machines in these conditions would perform, and it's a very very difficult question to put a figure to in the absence of particular

A (Continued) experience in that locality. Certainly in southern British Columbia for instance where continuous miners were being used at that time the figure was certainly towards the lower end of the range; but as I recollect the figure chosen at this particular point in time was somewhere in the order of 440 tons per machine shift. And, of course, once you have, if I may put it like this, plugged this figure in as with the longwall then your whole cost calculations are dependent on those figures for your production costs.

Q What other

A The other thing is at this time it was predicated that all the underground mining operations would work basically a seven day week. That is 340 or thereabouts days per year. That is a totally continuous mining operation, and this required, of course, a great deal of cooperation and forbearance from the miners, particularly from British miners who weren't in any way accustomed to working on this basis, but were accustomed to working on a five production day two days off weekend basis. But it was insisted that, and perfectly true from a theoretical point of view that if one wants to get the maximum possible utilization out of one's equipment then you work 24 hours a day seven days a week, but you may only do that in relation to the other constraints that exist, and whether one can persuade the labour force to operate on that basis, whether one can adequately maintain one's equipment and so on, but this number was plugged into the calculations and was a fundamental assumption that was made that the mine

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A (Continued) could and would operate on a seven day rather than a five day week basis.

A (continued) And then lastly with the rates of progress that were scheduled before the development work, before the longwalls came into operation, could be maintained and that the work would be performed in the time schedule as planned and the initial requirements of the contract, which I think were for a million and a half tons in the first year of production and afterwards 2 million tons, could be reached at particular points in time.

Q Now, were the underground physical conditions and the labour problems known quantities at that time?

A No. Certainly the underground conditions were not known to any full extent, of course. Some development work had been done in No. 4 seam at No. 2 mine by August 1969 and that, of course, had not been without its problems of roof control, of slow rates of advance compared to what had been expected. So, there were indications I think at this time that everything in the garden wasn't lovely, if I may put it like that. In other words, perhaps some of the more hopeful expectations were not being realized.

Q How would one go about attempting to get more concrete information before committing to the contract, Mr. Wardell?

A Well, there are a number of things. First, you need to know the basic structural geology of the area, that is how the seam sits, whether it is synclinal form or anticlinal form, what the gradients are, what the variations in seam thickness are, whether there are variations in the nature of the strata immediately above the seam; a good many things that one can

A (continued) obtain information about this by drilling and normally that would be the practise. No extensive mining area would be developed without a great deal of information obtained from drilling.

Q Had that been obtained in connection with these reserves?

A No, not to any great extent. The outcrops had been exposed and proved and some drill holes had been done. I believe there were two or three in the No. 2 mine area and I believe there was one in the No. 5 mine area, but by the same token I think I should say that, of course, drilling was extremely difficult in these conditions. The topography was very, very rugged and every time you had to put a drill hole down you had to make a cat road up to the site. In the middle of these structures the depth was very considerable, in places approaching 1500 to 1800 feet, so that there was a great deal of drilling to do and it certainly would have required time and a fairly considerable expenditure of money to get as much information from drilling as would have been considered necessary for most coal mining projects.

Q There was, as you mentioned, a substantial amount of cover over the areas that were to be mined, in some areas at least, is that correct?

A Yes.

Q Does that exercise any constraint on your prediction, cost prediction or production figures?

A Well, it is notorious that the deeper the seams you are working and the greater the pressures and stresses develop at the

A (continued) mining level and the more problems of ground control you have to cope with, and the more problems of ground control you have to cope with the higher is likely to be the expense of production. This is a very simple process but one fundamentally accepted, I think, by all mining engineers.

Q Were there any successful longwall operations or any longwall operations operating at that time in the same depth of cover as projected for the proposed longwall operations at McIntyre?

A Oh, yes. The problem was so far as longwall is concerned, specific longwall operation was not -- the question in relation specifically to longwalls were being mined at 2,500, 2,600 feet deep in Germany and France and in England, but the major problem lay in keeping the access roads to the longwall open at these depths and this was achieved in England very largely not by the system of longwall proposed here, which was a retreating system, but by using an advancing system, the roadways were maintained behind the face and, of course, they are maintained at very great cost.

Q All right, what other information would you want to obtain before making these determinations that the reserves were economically adequate for your contract? We have talked about the geological information, what about underground physical conditions?

A Underground physical conditions, there are two possibilities. You can make use of what information is available in analogous conditions and I suppose it was true to say that the only analogous conditions are not a strict analogy to the operations

A (continued) here, would have been those that have taken place at various times, some of which are still taking place up and down the Rocky Mountains, foothills. The mines of Crowsnest Industries, the mines of Coleman Colleries, the mines of Canmore are particularly those that come to my mind. These at any rate gave some evidence of the particular problems associated with mining in Rocky Mountain conditions.

Q What problems did they give evidence of?

A Well, almost all of these have shown some of the features, if not all of them spoken about by Dr. Barron this morning, of the high thrusting, of thrust faults in the strata, of the seam, of a very soft coal, of high stress conditions leading to difficulties in roof control. All these features at one place or another have characterized the underground mining as I have seen it in southern British Columbia and in Alberta at Coleman and Canmore. So, there was that experience available and I think was available to the company. They had the advantage of Mr. Gardener who had worked in those conditions and Mr. Hurlbert who had been Manager for some time at Crowsnest Industries, so there must have been some awareness I think of the analogy that existed here. What weight it carried in determining the numbers I don't have any means of determining.

Q Now, in order to assess the problems in the particular area, would you suggest that some sort of pilot operation should have taken place?

A There was evidently a great deal to be gained by doing a pilot operation. I tried to define what I would mean by a pilot

A (continued) operation. That would be to open up sufficient area of ground to have, in several directions, not merely in one direction, because one doesn't get the full influence of the structure and the geology by taking a set of entries in one direction but by taking the entries in several directions, by opening a block of ground and by carrying out some experimental mining, which certainly, in my judgment, wouldn't have been longwall at this time but some form of pillar extraction with continuous miners because one of the great problems with continuous miners and getting good pillar extraction is to get the roof to break properly and adequately and there really wasn't any indication, just a furore that this was going to be possible, but having said this, this would have involved mining on the scale or would have involved time and cost which, had it not been very satisfactory, might have meant abandoning the project completely.

Q Now, was such a proposal actually put forward at one point?

A Yes, it was.

Q In what circumstances?

A If I may just refer to my notes?

Q Was it put forward by Mr. Price?

A Yes, it was indeed in a report signed by Mr. Price, I think I have it now, it is only a question of finding the right page. It is at page 35.

Q June of 1966, a proposal for a preliminary development project?

A That is correct.

Q And the objectives of that project were set out in paragraph

Q (continued) 2.19 of your report?

A That is right.

Q To determine or verify the physical nature of the deposit and the effectiveness of the continuous mining machine and the ability of one machine to work on steep pitches?

A That is correct.

Q Was it carried out?

A I think some small part of it was carried out. In other words, some development took place at No. 2 mine in No. 4 seam but in no sense could be described as a preliminary development project as envisaged here.

Q At the time that the decision was made to go ahead with the contract, what as far as you can determine was the basis of the cost information that was used to produce a cost target or cost figure such as you mentioned a little while ago? What was it based on?

A If I can say what it was based on in principle and then perhaps have a moment to look for specific figures?

Q Yes, sir.

A It was based in principle on being able to carry out development in No. 4 seam with continuous mining equipment at a given level of performance. In terms of tons per machine shift or terms of output per man employed on a machine, and secondly, it was predicated on the longwall faces producing at a certain level of productivity. Again perhaps best measured in terms of output per shift and having got those two figures on the application of a certain number of men in order to perform those

A (continued) operations.

Q Was there any cost information relating to longwall in steeply pitched seams or hydraulic mining in steeply pitched seams used in making the calculations?

A I don't think any information which was specific to longwall mining in steeply pitched seams was used in the predictions but, equally, I don't think there was any information specific to hydraulic mining in other countries or other localities which was used in making any predictions.

Q And did you have a figure there, Mr. Wardell?

A I have a figure from the August 1969 study of productivity on an output per man shift basis and the productivity is scheduled at full production for mines 2 and 5 for all underground workers was 18 tons and 19.6 tons respectively. I don't have immediately here the figures in terms of machine shift productivity for continuous miners on development or for the longwalls on which these figures were based but, with a few minutes, I could get those.

Q What comment can you make on that productivity, what would be necessary to ensure that kind of figure?

A Well, these were very high figures for labour productivity by any known standards. The average figure I guess for the United States at about that time was somewhere in the order of 15 or 16 tons. Of course, there were mines that were doing considerably better than that but by the same token mines which were doing considerably worse. The average productivity of European mines at that time was less than 3 tons per man shift and

A (continued) admitting the many, many differences in circumstances what this predicated was a very, very high level of achievement.

Q And were the calculations all based on a high level of achievement, Mr. Wardell?

A Yes.

Q Was there adequate information in the material that you investigated on costs, productivity or volume?

A I wonder if I might put it like this? There was adequate information if one looked at the broad mining scene, the information about the variability in performance, the fact of conditions, the dominance of physicial geological conditions on productivity, there was a great deal of information in this broad spectra that would have led one to be very cautious in my judgment in the circumstances.

Q On the information that the company had in their documents and in their analysis and in their studies, did they have adequate information on costs, productivity or volume?

A What I am finding difficulty, sir -- adequate information on costs?

Q Yes?

A What I am really trying to say, Mr. Stevenson, there was no information on operational costs in strict terms because no operations had been carried out. There was no historical data.

Q Adequate in the sense of being able to make this commitment?

A I think they could have made the, if they had made worst assumptions, may I put it like that, but the cost data that was

A (continued) available and that satisfied the cost constraints set by the contract, then there was adequacy in that sense.

Q If you took the worst information in each case?

A Surely.

Q And what was done to take an average or a high level or what?

A I think a higher than average level was taken.

Q Up to this point had there been any planning of strip operations?

A Up to August 1969?

Q Yes.

A To the best of my knowledge, no.

Q All of this contract or plan to be met with underground operations?

A At this time, yes.

Q Did the company have, from what you could determine, information about the availability of employees that they needed, the availability of skilled miners and trained miners?

A I think the company made quite extensive enquiries about the availability of miners already at this time through 1968 and certainly through early 1969, there were very extensive recruitment campaigns going on in a number of countries for skilled and experienced miners and supervisors and so on.

Q At the time that the decision was made to go ahead and execute the contract with the Japanese was there information on the potential labour force available?

A I really can't answer that question. I don't know what information on the potential labour force was available to the company at that time.

Q You indicated earlier that one of the factors that had to be considered was the availability of the people with the necessary skills?

A Surely.

Q What was the source of the availability that was projected?

A The sources primarily were the United Kingdom, Nova Scotia and Alberta itself, I believe some of the potash mining areas were canvassed. As I understand it those were initially the three principal areas of recruitment. I think these were later extended to other countries and other provinces.

Q All right. Now, in the operational phase Mr. Wardell, the decision was made to go into No. 2 and No. 5 mines?

A That is correct.

Q And problems were encountered in these operations at a fairly early stage?

A Yes. Unquestionably there were problems almost from the beginning.

Q What kind of problems?

A I think, broadly speaking, they can be categorized into the physical problems, either problems of roof control or problems of equipment mobility, there was a certain amount of water, there was a certain amount of gas. There were roof control problems, there were equipment problems, there were delivery of equipment problems and there was specific labour problems largely associated with a high rate of turn-over and a high absenteeism. These were the fundamental problem areas.

Q And did that apply to both No. 2 and 5 mine?

A Yes.

Q And the physical conditions in those two mines, what problems were encountered there?

A I think it was discovered that the simple roof bolting which generally it had been believed all the operations could proceed was not everywhere adequate and that a certain amount of timbering had to be done. I think there were problems because the coal was rather soft and as the entries advanced and there was greater cover and came under pressure there was a certain amount of spalling from the sides of the pillars, it meant that they needed a degree of support. By October, 1969 problems of floor heave had begun to make themselves felt. That required brushing which was not an operation that had been originally anticipated. So, these were the broad areas of ground control difficulties that arose.

Q Would those have been discovered or any of them been discovered in carrying out a development planning project such as Mr. Price had recommended earlier?

A Oh, yes, yes. Had that development been extensive enough.

Q Now, the production fell?

A It is doubtful to say that it fell. The production during 1969 and 1970 didn't achieve the targets that had been set.

Q How close did it come in general terms?

A Oh, mostly within the 70 to 80 per cent range.

Q And when production fell, what alternative sources of coal were then available as being planned or projected from underground sources?

A From underground sources? Still No. 1 and No. 3 mine and there was talk at this time of the No. 9 area as being probably the largest area of low-pitch coal in the whole of the Smoky River area which might be available for underground mining and indeed it was scheduled for underground mining in the early part of 1969.

Q When production fell below target in, let us say 1970 or 1971, did the company have any information or technology or technological plans to enable it to go into the No. 1 and 3 mine areas?

A There was certainly no formal plans, any entry into No. 1, No. 9 or No. 3 mine areas, No. 1 and 3 in particular would have largely had to have been on an experimental basis.

Q What was the back-up, or was there any back-up if problems were encountered in Nos. 2 and 5 mines?

A Were there any essential contingency plans in effect?

Q Yes?

A I know of none. I have not been able to find any evidence of any in the records other than of course the opening of No. 8 strip mine which was the action that was taken when it became fairly clear that Nos. 2 and 5 were not going to produce at the output levels that had been anticipated.

Q Now, Mr. Wardell, in January of this year a decision was made to close the No. 5 mine?

A Yes.

Q And you have heard Mr. Fulton's evidence that it was encountered -- that it was done as a means of reducing cost. Assuming it

Q (continued) was done as a means of reducing cost and it was necessary to reduce the cost, have you analyzed that decision to determine whether or not it was a necessary or proper decision to make to achieve that end?

A Yes.

MR. CRUMP: I think, Mr. Stevenson, it is one o'clock and you are commencing a new line of questioning, I think we will adjourn until tomorrow morning at 9:30.

(The Hearing stood adjourned.)